

REMARKS

Claims 1, 2, 4-9 and 12-34 are all the claims pending in the application.

Applicants' undersigned counsel had a telephone interview with the Examiner on March 10, 2010. The following remarks will refer to the telephone interview, and when so doing constitute a Concise Statement of Substance of Interview. No agreement was reached during the telephone interview.

Applicants have amended claim 1 as set forth above to even more clearly recite that claim 1 is directed to a carbon powder material.

In the final rejection, claims 1-11, 21, 22 and 28-33 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pub. No. 2002/0061445 A1 to Kitagawa et al.

As set forth in the Amendment Under 37 C.F.R. § 1.116 filed on February 12, 2010, the recitations of claims 10 and 11 have been incorporated into claim 1, and claims 10 and 11 have been canceled. Thus, claims 1 to 9, 21, 22 and 28-33 remain as being subject to this rejection.

Applicants submit that Kitagawa et al do not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

The present invention as set forth in claim 1 is directed to a carbon material for a battery electrode, which comprises a carbon powder material that is a composite of carbonaceous particles and a carbon material derived from an organic compound prepared by allowing the organic compound serving as a polymer source material to deposit onto and/or permeate into the carbonaceous particles to thereby polymerize the polymer material and then heating at 1,800 to 3,300°C, and which has an intensity ratio of 0.1 or more for peak intensity attributed to a (110) plane to peak intensity attributed to a (004) plane determined through X-ray diffraction spectroscopic analysis on a sheet obtained by press-molding a mixture of the carbon material and

a binder resin when pressed at 10^3 kg/cm^2 or higher. In the present invention, graphite crystalline structure regions and amorphous structure regions are dispersed from the surface to the center in each of the particles constituting the carbon material. Further, the area ratio of a region including a diffraction pattern having two or more spots to a region including only one spot attributed to a (002) plane is 99 to 30 : 1 to 70 in a $5 \mu\text{m}$ square region randomly selected from a transmission electron microscope bright field image of a cross-section surface obtained by cutting the carbon material for a battery electrode into flake form.

Applicants submit that Kitagawa et al do not disclose or suggest a carbon powder material wherein graphite crystalline structure regions and amorphous structure regions are dispersed from the surface to the center in each of the particles constituting the carbon material and wherein the area ratio of a region including a diffraction pattern having two or more spots to a region including only one spot attributed to a (002) plane is 99 to 30 : 1 to 70 in a $5 \mu\text{m}$ square region randomly selected from a transmission electron microscope bright field image of a cross-section surface obtained by cutting the carbon material for a battery electrode into flake form.

Kitagawa et al nowhere mention the presence of amorphous structure regions dispersed from the surface to the center in each of the particles constituting the carbon material and nowhere mention the area ratio of a region including a diffraction pattern having two or more spots to a region including only one spot attributed to a (002) plane is 99 to 30 : 1 to 70 in a $5 \mu\text{m}$ square region randomly selected from a transmission electron microscope bright field image of a cross-section surface obtained by cutting the carbon material for a battery electrode into flake form. This area ratio defines the physical properties of the final product.

The present invention is clearly different from Kitagawa et al in terms of a different final product.

Kitagawa et al disclose a carbonaceous powder of plural-layer structure with a surface layer of carbonaceous matter formed therein, which carbonaceous powder is used as a negative electrode material. Kitagawa et al disclose in paragraph [0012] that the carbonaceous powder of Kitagawa et al is prepared such that, using a lumpy graphite powder as a nucleus, this nucleus or the graphite powder is covered with a carbon precursor, which is then fired in an inert gas atmosphere at a temperature within the range of 700 to 2800°C, thereby causing the surface layer of the carbonaceous matter to form.

Kitagawa et al further explain this firing or heat treatment in paragraph [0043] at page 4, left column, lines 1 to 4, as being a heat treatment in which “the upper limit temperature can be basically raised to a temperature at which the structural order of the carbon precursor does not exceed the crystal structure of the graphite particle nucleus. Therefore, the upper limit temperature of heat treatment is usually 2800°C or less, preferably 2000°C or less, or more preferably 1500°C or less.”

Kitagawa et al illustrate the preparation of the carbon powders of their invention which have a plural-layer structure containing a surface layer of carbonaceous matter that has been formed on the surface of its nucleus in Sample Nos. 18 to 34, which are described in paragraph [0083] of Kitagawa et al. As disclosed in Paragraph [0083] of Kitagawa et al, a temperature of 1200°C is employed in the Sample Nos. 18 to 34 of Kitagawa et al, which is similar to the heat treatment of 1000°C employed in Comparative Example 2 of the present specification.

Applicants now note that in Paragraph [0087], Kitagawa et al state that “the baking temperature for obtaining the carbonaceous powder of plural-layer structure was 1300°C in the above embodiments.” The “above embodiments” are embodiments that employed Samples Nos.

18 to 34. It is not clear to applicants why paragraph [0083] refers to 1200°C, but paragraph [0087] refers to 1300°C.

Comparative Example 2 of the present specification obtained a final product that fails to exhibit the properties of the present invention even after the source material is deposited. As applicants have previously explained, the difference seems to depend on the ratio of the high crystallinity portions and amorphous portions of the product after the source material is deposited. That is, the ratio of the amorphous portions increases when the heat treatment after depositing the polymer source is carried out at a relatively low temperature as in Comparative Example 2, which results in a ratio out of the range as defined in claim 1 as amended above. Applicants submit that Comparative Example 2 serves as evidence that the Examples of Kitagawa et al did not achieve the product or results of the present invention, since the temperature of 1200°C (1300°C) employed in the Examples of Kitigawa et al is similar to the temperature of 1000°C employed in Comparative Example 2.

In the Advisory Action of March 9, 2010, the Examiner set forth the following comments in support of her position that the Amendment of February 12, 2010 did not overcome the rejection. Applicants have added paragraphing for ease of readability.

Applicant argues that Kitagawa et al. (U.S. Pat. No. 2002/0061445 A1) does not disclose or suggest the specified properties claimed which Examiner acknowledges, but Examiner takes the position that the method recited by Kitagawa et al does not appear to be patentably distinct from Applicant's method.

Kitagawa et al. teaches a carbonaceous powder prepared using a lumpy graphite powder as a nucleus then covering the graphite powder with a carbon precursor. Examiner believes the method recited by Kitagawa can be broadly interpreted to correspond with allowing the organic compound serving as a polymer source material to deposit onto the carbonaceous particles. Claim 1 specifically states "the organic

compound serving as a polymer source material to deposit onto and/or permeate into the carbonaceous particles". Applicant has written the claims so that the carbon precursor permeating into the carbonaceous material is not necessary.

Furthermore Kitagawa et al. teaches heating to a temperature range of 700 to 2800 °C which overlaps with Applicant's recited temperature range of 1800 to 3300 °C.

During the telephone interview with the Examiner on March 10, 2010, the Examiner stated that she believed the present invention was different from Kitagawa et al because Kitagawa et al only form a layer on the graphite powder, but in the present invention the polymer source material was present throughout the particles. The Examiner stated, however, that she believed the method recited in the present claims could be the same as the method disclosed in Kitagawa et al because the method in the present claims does not require permeation and can be satisfied by a mere deposit on the surface, which according to the Examiner is the method disclosed in Kitagawa et al.

Applicants submit, however, as stated during the telephone interview, that the present claims are directed to a product, and that the claims set forth product recitations and properties that distinguish the present invention from Kitagawa et al. Since the Examiner appears to recognize that the product set forth in the present claims is different from and not suggested by Kitagawa et al, it follows that the present claims patentably distinguish over Kitagawa et al. The Examiner appears to have ignored the product recitations of the present claims in determining patentability, and appears to have focused on method recitations. However, since the present claims are product claims, the product recitations cannot be ignored and must be given full weight in determining patentability.

Further, the present specification discloses that various steps can be taken to bring about a permeation into the core of the carbonaceous particles, such as performing evacuation of the

reaction system, as disclosed at page 20, line 30 to page 21, line 9. Kitagawa et al do not disclose steps to bring about a permeation into the core of the carbonaceous particles and therefore do not disclose a method which would produce the powder of the present invention.

With respect to the Examiner's comment that Kitagawa et al teach heating to a temperature range of 700 to 2800°C which overlaps with applicants' recited temperature range of 1800 to 3300°C, applicants note that Kitagawa et al disclose such a temperature range at various points in their publication. As discussed above, paragraph [0083] of Kitagawa et al discloses a temperature of 1300°C. In paragraph [0087], Kitagawa et al disclose that in the embodiments shown in the Tables, the baking temperature was 1300°C, "but similar powder properties were achieved in a temperature range of 700 to 2800°C., whereby same effects as in the present invention [the invention of Kitagawa et al] were confirmed."

As discussed above, applicants submit that Comparative Example 2 serves as evidence that the Examples of Kitagawa et al did not achieve the product or results of the present invention, since the temperature of 1200°C (1300°C) employed in the Examples of Kitigawa et al is similar to the temperature of 1000°C employed in Comparative Example 2.

Applicants note that the Examiner has not specifically commented on applicants' arguments concerning Comparative Example 2 of the present specification.

Since Kitagawa et al state that "similar powder properties were achieved in a temperature range of 700 to 2800°C," applicants submit that one would not have any reason to expect that the properties of the Kitagawa et al powder at temperatures of 1800 to 2800°C would be different from those at 1200°C/1300°C.

In particular, Kitagawa has the following description in paragraphs [0086] to [0087].

[0086] ... In these cells, the 1/5 C discharge capacity after being left at a high temperature was 82 to 96% of the 1/5 C discharge capacity before being left at the high temperature, which means, the 1/5 C discharge capacity after being left at a high temperature was enhanced by using the carbonaceous powder of plural-layer structure. Of these cells, in all of the cells AA, AB, AC, AD, AE, and AF respectively made of the sample carbonaceous powder of plural-layer structure Nos. 27, 28, 29, 30, 31, and 32, the 1/5 C discharge capacities after being left at a high temperature were at least 530 mAh or more, that is 93% or more of the 1/5 C discharge capacity before being left at the high temperature. It is concluded from these results that those that were excellent in all aspects of battery performances were cells AA, AB, AC, AD, AE, and AF respectively made of sample carbonaceous powder of plural-layer structure Nos. 27, 28, 29, 30, 31, and 32.

[0087] Incidentally, the baking temperature for obtaining the carbonaceous powder of plural-layer structure was 1300°C. in the above embodiments, but similar powder properties were achieved in a temperature range of 700 to 2800°C., whereby same effects as in the present invention were confirmed. Also, the carbonaceous powder of plural-layer structure was prepared by mixing the nucleus material and the pitch so that the ratio by weight of the graphite powder used as the nucleus and the carbon matter newly forming a surface layer will be 95:5, but similar properties were obtained with this ratio by weight being within the range of 99:1 to 50:50, whereby same effects as those of the present invention were achieved.

That is, Kitagawa et al disclose carbonaceous powder of plural-layer structure and teach that similar powder properties can be achieved in a baking temperature range of 700 to 2800 °C. Although the Examiner takes the position that the method for making the carbon material taught by Kitagawa et al may be similar to that claimed by applicants, applicants submit that one of ordinary skill in the art would understand that a particle in which graphite crystalline structure regions and amorphous structure regions are dispersed from the surface to the center as claimed

in the present invention is not disclosed or suggested by Kitagawa et al and cannot be obtained by the method taught by Kitagawa et al even at a baking temperature of 2800°C.

In view of the above, applicants submit that Kitagawa et al do not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

Claims 1, 2, 6-8, 10, 11, 13-20, 22, and 28-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilde et al (U.S. Pub. No. 2003/0194557 A1).

Applicants submit that Wilde et al do not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

Wilde et al disclose a carbon fiber electrode substrate comprising a paper made from carbon fibers. Wilde et al disclose impregnating this paper with a slurry comprised of carbonaceous particles in a solution or dispersion of binder polymers that form a carbonaceous residue upon heating in an atmosphere devoid of oxygen at a temperature of at least 800°C.

Wilde et al disclose, in paragraph [0063], lines 4 to 8, the step of impregnating the paper with a slurry containing a carbonizable or graphitizable binder and dispersed graphitic particles, and then subsequently heat treating to carbonize or graphitize the binder.

Wilde et al disclose in paragraph [0064], lines 2 to 5, that the particulate carbonaceous material that is employed can be synthetic graphite powder, graphite nanofibers, expanded graphite or mixtures of graphitic carbon particles.

Wilde et al disclose in paragraph [0071], lines 8 to 11, that during the carbonization or graphitization process, the carbonizable or graphitizable binder that surrounds the graphite particles is converted to carbon and a nearly all carbon product is obtained.

The carbon material that is obtained in the present invention is a powder, and not a carbon paper as in Wilde et al. Wilde et al do not disclose or suggest the carbon powder of the present invention, and only disclose a carbon paper. As can be seen from the above, Wilde et al are completely different from the present invention in terms of the structure of the produce and the objectives of the invention.

In the Advisory Action, the Examiner acknowledges that applicants have argued that the rejection based on Wilde et al. (U.S. Pub. No. 2003/0194557 A1) should be withdrawn because the carbon material obtained by applicant is a powder while the material obtained by Wilde et al is paper. The Examiner, in the Advisory Action, takes the position that the previously presented claims do not specifically claim a carbon powder comprising carbonaceous particles and a carbon material derived from an organic compound etc. In particular, the Examiner stated that one of ordinary skill in the art could interpret the previous language of claim 1 to mean a composite comprising carbon powder, carbonaceous particles and a carbon material derived from an organic compound.

While applicants do not agree with the Examiner's interpretation, applicants have amended claim 1 as set forth above to even more clearly recite that claim 1 is directed to a powder.

In view of the above, applicants submit that Wilde et al do not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

Claim 12 has been rejected under 35 U.S.C. 103(a) as being unpatentable over the prior art cited as applied to claim 1 above, and further in view of Yin et al. (The effect of Boron Doping on Lithium Intercalation Performance of Boron-Doped Carbon Materials; Material of Chemistry and Physics; 80, 94-101; 2003).

It is applicants' understanding that the Examiner is referring to Kitagawa et al when she refers to the prior art as applied to claim 1 above, since she refers to Kitagawa et al in her detailed statement of this rejection.

Since claim 12 depends from claim 1, which possesses unobviousness for the reasons discussed above, applicants submit that the subject matter of claim 12 is not rendered obvious by Kitagawa et al and Yin et al.

In view of the above, applicants request withdrawal of this rejection.

Claims 13-20 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Kitagawa et al. as applied to claim 1 above, and further in view of Morita et al. (U.S. Pub. No. 2003/0044603 A1).

Applicants submit that Kitagawa et al and Morita et al do not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

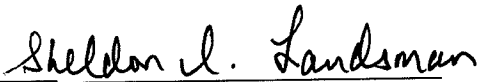
Since claim 13 depends from claim 1, which possesses unobviousness for the reasons discussed above, applicants submit that the subject matter of claim 13 is not rendered obvious by Kitagawa et al and Morita et al.

In view of the above, applicants submit that Kitagawa et al and Morita et al do not disclose or render obvious the subject matter of claim 13 and, accordingly, request withdrawal of this rejection.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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